indicates the variety and condition of the fruit; quantities of n/10 NaOH required to neutralize; and the per cent of acidity in terms of citric acid.

TABLE SHOWING ACID CONTENT OF TOMATO FRUITS

Variety	Condition			Average no. of cc. of n/10 NaOH, to neutralize	Total per cent of acid as citric
	When picked	Interval or incubation	When titrated*		
Dwarf Stone	Ripe	0	Red	1.695	.52
Dwarf Stone	Half grown	0	Green	1.82	.56
Dwarf Stone	Half grown	Incub. 32° C. 10 days	Artif. yellow	2.135	.66
Dwarf Stone	Half grown	Lab. 24 days	Red	1.375	.42
Dwarf Stone	Half grown	Incub. 32° C. 10 days	Green	1.485	.46
Sparks' Earliana	Ripe	0	Red	1.695	.52
Sparks' Earliana	Half grown	0	Green	1.87	.58
Truckers' Favorite	Half grown	Incub. 32° C. 22 days	Artif. yellow	2.56	.79
Truckers' Favorite	Half grown	Lab. 24 days	Red	1.66	.51
Red Peach	Half grown	Incub. 32° C. 22 days	Artif. yellow	2.115	.65
Red Peach	Half grown	Lab. 24 days	Red	1.675	.52
Yellow Peach	Half grown	Incub. 32° C. 22 days	Artif. yellow	2.47	.76
Yellow Peach	Half grown	Lab. 24 days	Yellow	2.065	.64
Yellow Plum	Ripe	0	Yellow	2.12	.65
Yellow Plum	Half grown	0	Green	1.92	.59
Yellow Pear	Half grown	Incub. 32° C. 20 days	Artif. yellow	1.60	.49
Yellow Pear	Half grown	Lab. 24 days	Yellow	1.395	.43

* All fruits designated "red," "yellow," and "artificial yellow" were, at the same time, ripe.

The results above reported may not yet be as extensive as might be desired in order to follow closely the changes in acidity under different conditions; but they consistently point out certain relations of interest which may be briefly enumerated as follows: (1) A comparison of the acid content of green and normally ripened fruits was made, using Dwarf Stone, Sparks' Earliana, and Yellow Plum, all direct from the field. There were no marked differences between the green and ripe stages within the variety; yet the acidity of the green fruits of the red varieties in these tests is somewhat higher, while the acid content of the green fruits of the one yellow variety tested is somewhat lower. (2) Fruits of Dwarf Stone, Truckers' Favorite, Red Peach, Yellow Peach, and Yellow Pear which

were picked green and ripened in the incubator at 32–33°C. (10–22 days) exhibit a higher acid content than either those ripened on the vines or those ripened at the temperature of the laboratory. (3) There are considerable differences in the acidity of varieties, but judging from the results of these tests the normally ripened fruits of yellow varieties commonly contain as much acid as those of red varieties.

The several facts brought out by these tests render it obvious that there is now no sufficient evidence to justify relating pigmentation to total acidity. The acidity changes are, however, interesting in themselves, in these as well as in other fruits. No attempt was made to follow progressively any changes in acidity induced by conditions; but in titrating on one occasion, after an interval of two days, new samples of both red and yellow fruits which had been ripened in the laboratory, it was found that the acidity had noticeably declined since the previous titrations from the same lots of fruits.

We have reckoned the acidity of the tomato in terms of citric acid, as is customary. It should be noted, however, that while Bowman (3) and others report citric as the chief acid of the tomato, Albahary (1), on the contrary, gives .48 per cent as the malic acid content and .09 per cent as that of citric acid in the fresh fruits. The author last mentioned gives no indications respecting the variety or condition of the fruit employed. In a later contribution (2) he reports the results of analyzing tomato fruits in different stages of maturation, as follows: "1° le fruit vert avant l'apparition de la graine dans la pulpe; 2° le fruit vert au moment où la graine est complètement formée; 3° le fruit rouge arrivé à sa pleine maturation." In the second stage, corresponding to practically full grown, green, he finds .58, and in the ripe fruits .42 per cent of organic acids. This is in complete agreement with our findings. In the earliest stage of fruit development Albahary finds an acid content of only .116 per cent. Wehmer (5), after quoting Albahary (1) as to the percentage of the various acids in the fruit, remarks, "Die Acidität wechselt stark je nach dem Reifestadium (von 0,06–0,697% des Saftes auf Citronensäure berechnet)." He does not indicate the

source of these data, and certainly the smaller percentage given can refer only to the youngest stages of fruit development.

Graduate Laboratory, Missouri Botanical Garden.

Literature Consulted

1. Albahary, J. M. Analyse complète du fruit du Lycopersicum esculentum ou Tomate. Compt. rend. acad. Paris **145**: 131–33. 1907.
2. ———, Étude chimique de la maturation du Lycopersicum esculentum (Tomate). Compt. rend. acad. Paris **147**: 146–47. 1908.
3. Bowman, W. Tomatoes: chemical examination of fruits. Va. Agr. Exp. Sta. Bul. 9: 16–18. 1891.
4. Duggar, B. M. Lycopersicin, the red pigment of the tomato, and the effects of conditions upon its development. Washington Univ. Studies **1**: 22–45. 1913.
5. Wehmer, C. Die Pflanzenstoffe 685–86. 1911.

A METHOD FOR THE DIFFERENTIAL STAINING OF FUNGOUS AND HOST CELLS

R. E. VAUGHAN

Assistant in Plant Pathology, University of Wisconsin

Exchange Fellow in the Henry Shaw School of Botany of Washington University

In making histological studies of fungi on living or dead plant tissues the use of the stain known as "Pianeze IIIb" has been found very satisfactory in differentiating the fungus from the plant substratum, this differentiation occurring both in lignified and unlignified cell walls. The host tissue stains green and the mycelium a deep pink. This stain, devised by Dr. Pianeze for the study of cancer tissue,[1] is made up as follows:

Malachite green	0.50 gm.
Acid fuchsin	0.10 gm.
"Martius gelb"	0.01 gm.
Water, distilled	150.00 cc.
Alcohol, 95 per cent	50.00 cc.

Dr. Pianeze reports that it gives the following staining reactions: green in chromatin of resting or dividing nucleus, rose in cell protoplasm and membrane, and red in cancer bodies. For use with plant tissues the procedure is as follows: Wash in water or alcohol, stain in the undiluted mixture 15–45 minutes, remove excess stain in water, and decolorize in 95 per cent alcohol to which a few drops of hydrochloric acid have been added. For permanent mounts, clear with a carbol-turpentine mixture, remove clearer in xylol, and mount in balsam. Preparations of *Stereum*, *Corticium*, and *Polystictus* have been made with great success.

This stain is also valuable for staining germinated spores on the surface of a leaf. The procedure in this case is as follows: Infect marked portions of a leaf with a suspension of spores applied with a pipette, and place the plant under suitable conditions for fungous growth for 24–48 hours. Then permit

[1] Pianeze, G. Beitrag zur Histologie und Aetiologie des Carcinoms. Beiträge z. path. Anat. u. z. allg. Path. Supplement 1: 1–193. 1896. [cf. p. 58.]